MOUNTAIN SAFETY RESEARCH

NEWSLETTER

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PURPOSE

Mountain Safety Research, Inc. is a volunteer organization of persons interested in promoting mountaineering safety, as part of their own enjoyment of the sport. By policy, the operation will be without net profit; all available funds will be used for further methods and equipment development and for safety education.

ABOUT MSR

In the spring of 1968, I, your editor, enrolled in the intermediate climbing course of The Mountaineers, Seattle, after having climbed Northwest mountains for 33 years without mishap. The particular stimulus for taking the course was an accident to a 13-year old girl who was a member of a party I was leading. She slid on an icy slope into a deep snow socket, hitting her head on the tree. She was knocked unconscious, head bleeding, and her face went into spasm. Dr. Otto Trott's lecture on head and spinal injuries was fresh in my mind, and I really had a sinking feeling, thinking that her spinal cord had been damaged. We carried out a good rescue, and were fortunate that she had no permanent injury. But I was scared, since I realized that I had made several leadership errors. Hence, I took the course, renewed my First Aid cards, and started thinking how to become a better mountaineer and leader.

Being an engineer and professional inventor, I kept an investigative mind in the course and was soon asked by the chairman to try to learn why several 3/8" Goldline (twisted nylon) ropes had broken a few years earlier in crevasse and snow practice. But when I started testing, the first thing that broke was a carabiner, with a fall of the 200-lb. dummy of only 30 inches. On the next drop of the same distance, the rope broke. Consternation! What goes on here?

From that starting point, the work has continued for one and one-half years now, covering many topics.

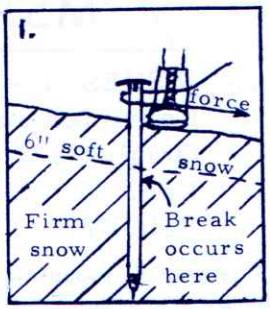
- Elongation of ropes
- Energy absorption of ropes
- Security of knots
- New knots
- New rope techniques
- Design of climbing ropes
- Strength of carabiners
- Design of carabiners
- Descending rings and slings
- Brake bar design
- Jam nuts
- Rescue pulleys
- Rock drills and bolts
- Holding power of pitons
- Design of new pitons
- Ice and snow screws
- Snow flukes and anchor plates
- Energy absorbing devices (Auto-Belayer)
- Strength of ice axes
- Design of stronger ice axes
- Ice axe guards
- Body harnesses
- Pack design
- Testing of storm shelters
- Igloo tools
- New gloves
- Breathing regenerators and masks
- Stove fuels
- Belaying techniques
- Belay anchor systems

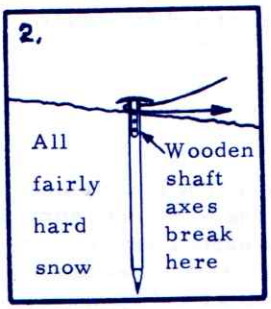
The results of the test work have been organized into three hours of lecture and demonstration with over 100 slides.

At first the work was organized as a committee of The Mountaineers. But the trustees provided no financial support. After six months, it became apparent that the outlay was more than I could manage alone, and so I formed Mountain Safety Research, Inc. as a vehicle to make and sell safety equipment as a means of supporting the equipment and methods research and the safety education program. Hence, your purchases help keep the work going. After a few mailings, you will be asked to donate $3 to cover the cost of publishing and mailing for a year. Donations of any size will be welcome, and $10 or more will bring you the designation of MEMBER, entitling (but not requiring) you to participate in work sessions, contribute technical and safety articles, give the slide lecture and otherwise help in safety education and to have your letters answered fairly promptly.

The editor is unpaid; his labor is donated as a volunteer. Equipment is made by normal factory personnel. (In the business world, the editor is president and chief physicist of Penberthy Electromelt Company, Seattle, and Penelectro Ltd., Leigh-on-Sea, England, melting and process engineers in the glass industry. The editor goes to Europe several times a year, which makes it easy for him to keep in touch with climbing and safety practices there.)

ICE AXE TEST METHODS





To help the investigation, please send a description of the breaking of ice axes you know about. We will publish results when we get enough reports.

Wooden ice axe shafts break at various places, according to the particular circumstances of loading. The top diagram shows a snow condition typical of a warm day in summer: the underlying snow is firm, and the top 6" of snow is soft. The axe is pointed across the slope, loading the axe in the weaker axis. With a boot axe belay, and the rope several inches below the head, the axe breaks about the middle of the shaft.

We have tested 14 axes in a laboratory fixture simulating this diagram. These included new and used, ash and hickory, plain and laminated. All broke at loads of only 150 to 250 pounds rope force. For comparison, the forces that can be generated in crevasse falls range up to 1000 pounds on icy snow, less on soft snow.

The lower diagram shows the axe being used as an anchor in crevasse rescue. The axe is plunged into the snow all the way, and the snow is fairly hard. The rope is next to the head. In our corresponding laboratory fixture, the only wooden axe we had for test (Grivel laminated) broke off at a load of 500 pounds. For comparison, an MSR axe with aluminum-fiberglass bent at 750 pounds.

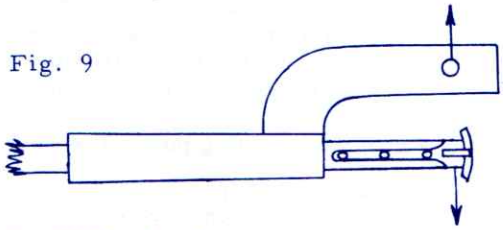
In an actual case like drawing 2, in crevasse rescue practice, the head of a new, normal wooden-shafted axe broke off under the weight of a climber while he was waiting to be pulled up!

Why is the test made with the axe in its weaker axis? Because the textbook, Mountaineering--Freedom of The Hills, Pp. 331 and 263, shows it being used that way. (2nd Edition, 1967, published by The Mountaineers, Inc., Seattle, Wash. USA.) Also, P. 81, Blackshaw: Mountaineering, 1968, Kaye & Lord, London. Page 261 of Freedom shows the axe with the pick pointed up the slope. The shaft is stronger, but the shaft's holding power in the snow is about a third weaker. Take your choice. A better way to deal with the question is to have a stronger axe shaft, and use it with the wide face resisting the force of pull-out.

More on TESTS for ICE AXES

On page 2, we described the test method in field-use terms. There are actually four laboratory tests which we use.

Fig. 9



Test One The shaft of the axe is supported in a pair of rope loops, 22" (56 cm.) apart. A loop of webbing hangs from the middle, and is used to pull down. The breaking force is measured in the rope loop nearest the head, to correspond with the belaying rope shown in Fig. 1. The force in the webbing is twice the figure we report.

Test Two The head half of the broken shaft is then pushed into a padded tubular fixture, to the end of the tangs, leaving all of the metal portion hanging out. A rope loop is placed over the shaft as near as possible to the head, and the head is then pulled off. See Fig. 9.

Test Three The spike is placed in a small tubular socket, and force is applied sideways at the head.

Test Four The metal ferrule over the shank of the spike is placed in another socket and the sideways load is again applied to the head.

TEST RESULTS ON SPECIFIC AXES

Grivel, hickory, good straight grain, 21 per inch, excellent condition. Test One: 250 pounds, green stick break, with some strength still remaining. Two: 500 pounds. Three: 50 pounds, 75° bend, no break. Four: 65 pounds.
This axe donated for test by Bruce Anderson, Altadena, California.

Simond Super D, ash, good straight grain, 11 per inch, used but in good condition. One: 146 pounds, clean complete break, long diagonal, which is typical of ash. Two: no test, because break extended into the tangs. Three: instead of bending the spike, the ferrule broke off at 30 pounds. Four: broke in Test Three.
This axe donated for test by John MacDaniels, Portland, Oregon.

Hope Alpinist, ash (?), good straight grain, 9 per inch, new. One: 150 pounds, long diagonal break. Two: 500 pounds. Three: 30 pounds, spike broke off. Four: 44 pounds.

Stubai Wallner, ash, good straight grain, 9 per inch, new. One: 150 pounds. Two: broke in crevasse rescue practice under weight of climber weighing 180 pounds. He had lowered himself smoothly, and did not fall. Three: 50 pounds. Four: 40 pounds.

Ralling Akademiker, ash, good straight grain, 9 per inch, new. One: 200 pounds, very long diagonal. Two: no test, because diagonal break extended into the tangs. Three: 30 pounds. Four: 44 pounds.

Grivel, laminated, 40 laminations per inch (called Rexilon), new. One: 250 pounds, swift complete break. Two: 500 pounds. Three: 44 pounds. Four: 62 pounds.

Comment on WOODEN SHAFTS

The MSR staff has had two wooden-shafted axes break in actual use and about 24 in testing, has many written reports from others of the breaking of ice axes in actual use, and has seen hundreds of broken axes sent in for repair. The conclusion for us is inescapable: WOODEN ICE AXE SHAFTS IN GENERAL ARE NOT UNIFORMLY STRONG ENOUGH FOR RELIABILITY IN ARRESTING FALLS.

When we lead climbs, we take at least five metal shafted axes to lend to other members of the party to be sure at least our belayer will have a good axe, and that reliable axes will be available if rescue is required.

Carabiner Hole One wooden axe in crevasse rescue use broke off at the lower end of the tangs when the pull came on the carabiner hole. If you use the hole, better reinforce the shaft with fiberglass first. Ref: Summit June '69, Letters.

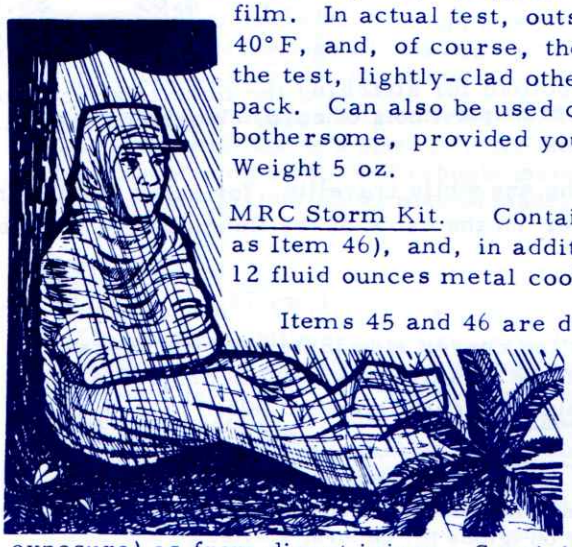
ICE AXE SHAFT REINFORCEMENT -- FIBERGLASS

With this fiberglass kit, you can strengthen your present wooden shaft at home. The technique is as simple as painting an axe, and the job can be done in less than an hour. The kit contains resin, activator, fiberglass cloth 8" x 34", plastic gloves, stirring stick, brush, sandpaper, and instructions. The strength of the axe will be raised to about 350-400 pounds, figure 1, and, best of all, will be reliably this strong. The cloth goes around the axe twice. Increases the weight of the axe by 3 oz.
Shipping weight 1 lb. Item 59 $3.00

The above kit provides clear resin. If color is wanted, order a vial of color: red, yellow, orange, green, blue. You can divide the mixed clear resin and use two colors if you like.
Item 59-C. Specify Color .65

We will apply the fiberglass on your axe if desired. Order Item 59, Item 59-C also if color is wanted.
Shipping weight for axes, 2 lbs. Item 60 Apply fiberglass $3.50

MRC Storm Shelter. 80" circumference x 96" long. Plastic tube to give you shelter from the elements. Reduces wind chilling and the loss of body heat in wet weather. Yellow color increases visibility from the air. Also, the color is partly opaque to infrared for better heat conservation, as compared to transparent film. In actual test, outside air was 13°F with 5 mph wind; inside the tube, the air was 40°F, and, of course, there was no wind. With occasional exercise, the person making the test, lightly-clad otherwise, could have survived the night. Should be in every summit pack. Can also be used over a sleeping bag for extra warmth. Condensation inside is not bothersome, provided you don't breathe inside the tube. Includes whistle and matches.
Weight 5 oz. Item 46 $1.00



MRC Storm Kit. Contains plastic tube shelter, survival information, and matches (same as Item 46), and, in addition, candle, sugar, salt, tea, bouillon, wire, signal mirror, and 12 fluid ounces metal cooking can. Weight complete 11 oz. Item 45 $2.00

Items 45 and 46 are designed and assembled by Mountain Rescue, Tacoma Unit, which is a volunteer organization dedicated to saving lives through rescue and mountain safety education. Your purchase of these shelters finances their operation, and, hopefully, decreases the number of times they have to go out on rescue.

It appears there were as many mountain deaths last year from hypothermia (lowered body temperature, sometimes called exposure) as from direct injury. Special discount of 15% in lots of 20 or more, any mix of Items 45 and 46, for the purpose of encouraging youth groups to have them. Anyone can get the discount: give them to your friends.

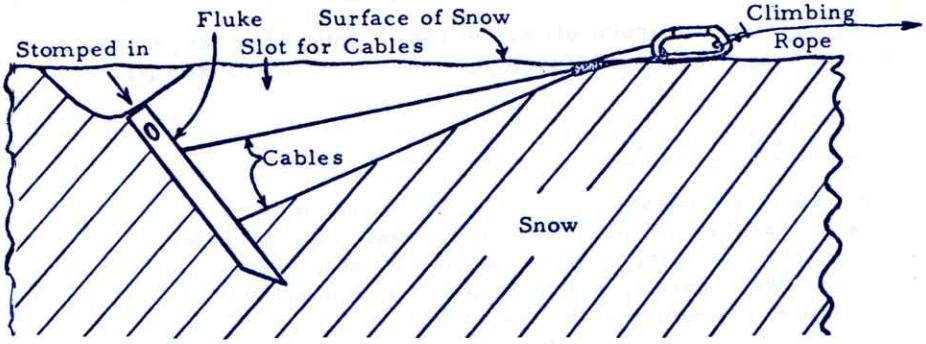
Hypothermia, Killer of The Unprepared, by Theodore G. Lathrop, M.D. A classic on death due to body cooling. 13-page booklet. Item 44 $ .75

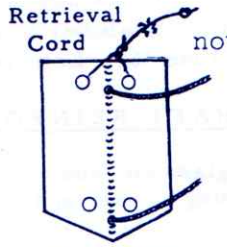
Frostbite, what is it, how to prevent it, and emergency treatment, by Bradford Washburn. 25-page booklet.
Item 48 $1.00

AV-A-LANCHE!

Snow time is here, and the time to be wary of avalanches. Dr. E. R. LaChapelle has written an excellent 47-page small book entitled "The ABC of Avalanche Safety". He describes: snow crystals; formation, mechanical properties, and thermal properties of the snow cover; avalanche characteristics, including loose snow and slab, in relation to terrain. He also gives warning signs of winter avalanche danger and tells why hard slab avalanches are the most dangerous and unpredictable in behavior. He describes wet snow avalanches, climax avalanches (which can be very large and destructive) and lists avalanche dangers in summer mountaineering. The second part of the book covers safety rules and discusses the following 10 steps to rescue: Don't panic; mark last-seen point; quick search; search surface below last-seen point; sole survivor; thorough search; probing; send for help; going for help; first aid. He concludes the book with a discussion of conduct of organized rescue action and a number of case histories. For anyone traveling in steep snow country, this book is a must. Dr. LaChapelle has a substantial background for this work: as snow ranger at Alta, Utah; Professor of Atmospheric Sciences; and glaciologist. Item 50 $1.00

MSR SNOW FLUKE





The MSR Snow Fluke is a belaying anchor to be imbedded in snow, and is made from a plate of high-tensile aluminum, bent to a shallow angle for stability and strength. The bent plate has the function of one of the flukes on a ship's anchor, hence the name. Steel cables are attached to stabilize the angle of the fluke to the cable eye A slot should be cut with the pick of the ice axe in the snow in the direction of pull to receive the cables. On heavy load, the fluke sails deeper into the snow, and absorbs energy as it goes. In typical, consolidated (but not re-frozen) snow, the 5" x 10" fluke sailed into the snow 20" and along 30", with a restraint of 1600 lbs. This equals the energy of a 200 lb. climber falling 20 ft. The fluke did not come out, and could have absorbed much more energy. Reference: Mountain Magazine (British) January 1969; Summit, March 1969; Clogwyn Climbing Gear, North Wales.

Cables test 3500 pounds.

Patent applied for

				Less Patronage Dividend	Net
Item 11	4" x 7"	Wt. 7 oz.	$6.50	$.65	$5.85
Item 12	5" x 10"	Wt. 13 oz.	$6.95	$.70	$6.25
Item 13	8" x 12"	Wt. 24 oz.	$7.25	$.75	$6.50

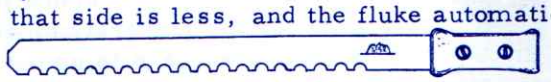
We have now added four holes, two near the top and two near the bottom for attaching the fluke to an ice axe for use as a shovel. Attachment is by means of hose clamps or multiple turns of cord. Works quite well.

Also, Bill Leavens, Seattle, has suggested leaving the fluke on the axe while travelling, for quick driving into the snow for belay. The climbing rope passes through a carabiner on the cable of the fluke, More on this technique after testing this summer.

Hose Clamps with thumb screw, stainless steel Item 76 $1.50 pr.

Some persons have asked why the fluke has the cables coming out the convex side instead of the concave side. The reason is flight stability, same as with a kite. If the fluke tips to one side, the projected area on that side is less, the force on that side is less, and the fluke automatically rights itself.

MSR IGLOO TOOL



In stormy, cold weather, an igloo is warmer, quieter, more restful, and more durable than a tent. Expeditions now often carry only one or two tents for emergency, and rely on igloos for general shelter. The MSR igloo tool is a springy aluminum blade with wavy edge and blunt teeth for soft and hard snow. A safer tool than a machete or hacksaw blade. No scabbard needed. 24" total length with lacquered wooden handle. In an emergency, can cut wood. With instructions for igloo building. Weight 7 oz. Item 34 $5.95

EDMONT COLD WEATHER GLOVES

Insulated permanently with polyurethane foam, waterproof, reasonably flexible, orange color. Snug fitting knit cuff is silicone-treated by MSR for non-wicking. Slightly rough surface for good gripping qualities. Excellent for igloo building and general snow and cold-weather use. Men's large size only. Item 52 $2.95

BUILDING AN IGLOO Text by Pat Polinsky

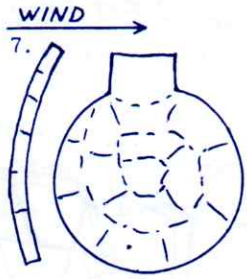
There are few conditions, if any, in which an igloo cannot be built from snow. Snow conditions may not be perfect, but as a rule of thumb, use that snow which is at the depth where your foot stops sinking. This may require that you discard top layers of snow. Some snow types will require more time and practice for ease of handling the snow. Tramping on the snow to pack it may make the snow useable. Wait a few minutes for the snow to re-freeze before cutting blocks. Sometimes the top layer of snow is not suitable and must be discarded so that the second layer of snow is accessible.

To build a snowhouse requires little equipment. A blade tool, and possibly a string 3 to 6 feet long to draw the diameter of the house, is all that is necessary. A ski, flattened limb of a tree, or even gloved hands can be used to cut blocks in an emergency. Heavy duty, waterproof gloves help to keep the hands warm and dry.

After the house is completed, its soundness is surprising. It is waterproof (water will run down through the snow blocks and will not drip), sound proof (noises from the outside cannot be heard from within), windproof (the air within is still), and it is strong structurally. The insulative properties in extreme cold have been noted by the Arctic explorer, Stefanssen. He found the outside temperature in a certain condition to be -50°. Other temperatures around and within the igloo were: -45° at the entrance, -40° at the floor of the entrance, 0° at the door, 20° at the level of the beds, 40° at the shoulder level, and 60° F at the ceiling.

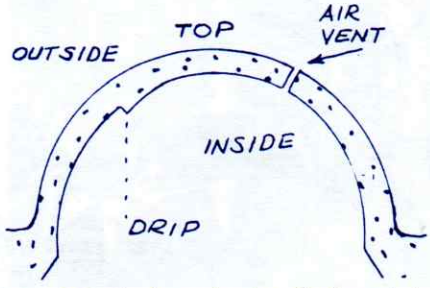
Although temperatures in the Cascades will not be this extreme, you may experience them on an expedition undertaken in future years. The actual temperature may not be extremely low but strong winds quickly lower the surface temperature.

When building the igloo, the maximum practical diameter should be about ten feet. The limiting factor in the diameter is the increase in height and the difficulty due to the larger diameter. With larger diameters construction of a perfect dome shape is demanded for structural stability.



Since the igloo entrance is NEVER sealed or closed (to insure proper ventilation), the top of the entrance should be about 18 inches lower than the bed platform to prevent the warmed air from escaping. When building the igloo, the entrance should be placed so the wind blows past the opening and does not pile snow into it. Strong winds which contain airborn snow and ice particles may cut through at the base of the igloo. Protection is achieved by placing extra blocks of snow at the base on the windward side.

Retention of the insulative properties of an igloo can be disrupted by man-made conditions and by conditions imposed by the weather. When cooking within the igloo, make sure the roof contains a ventilation hole. Drips within the igloo occur where a projection from the surface has been left. To remedy this, pat the surface smooth. With a smooth surface, the water will run down within the snow blocks.



Extreme cold can cause hoarfrost to form on the inside of the igloo when the house is too thin. Loose snow packed on the outside of the igloo will increase the thickness.

The construction within the igloo is left to the creativity of the builder. Construction of a place to leave the pack, a place to cook and a place to set a candle or flashlight increases the pleasure of staying in the igloo. Windows may be made, if you want to be very fancy, by placing sheets of clear lake ice in your walls.

POINTS TO REMEMBER: Check construction drawings attached.

1. Make snow blocks as LARGE as possible (6" thick, 18" high, 30" long).
2. If building on a hillside, cut first layer level as shown in the drawing for the 4-man igloo. Then spiral cut and complete as in a normal house.
3. Tilt each layer in MORE than the layer beneath to form a true dcme.
4. Pack the joints gently with handfuls of snow as you go. This helps to keep the blocks from toppling.
5. Build a SMALL igloo (6 feet or less in diameter) the first time. (To increase the space, undercut underneath and beyond the dome.)
6. For safety, always provide adequate ventilation for breathing and cooking.
7. Leave a light on in your igloo when you leave it at night. You may want to find it.

When cutting blocks, the igloo tool, Page 4, is not used as a saw except to get through icy layers. Instead, the blade is plunged into the snow and the handle is pulled parallel to the surface of the snow. See Fig. 16.

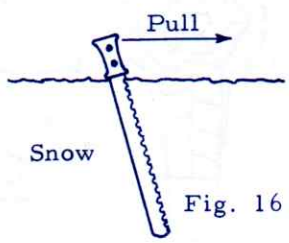


Fig. 16

The three-block long-house shown in Fig. 17 is fast for a single shelter, and permits you to stretch out and sit up. Being cramped in a snow house which is too small is no fun. Start by cutting out blocks for the head wall to make a hole 24 inches deep, 30 inches wide. Then cut blocks from behind you for the sidewalls and roof. Nearly all the blocks you need

will come from the trench thus formed. Note that the three blocks do not need to be set simultaneously. After the head wall is built up as a starter, the sidewall blocks can be set in place one at a time, at the angle shown, by contacting the block to the head wall and packing the vertical joint with snow as a mortar. The block will stay in place if held steady a few seconds. The top block is then lowered gently onto the slant blocks, and the upper joints are pressed lightly with snow. Make the top block long enough to overhang toward you a few inches, and then the next slant blocks can lean on it. After completion, the flat roof is made rounded by patting on more snow for arch stability. Side holes at floor level can be made for pack storage.

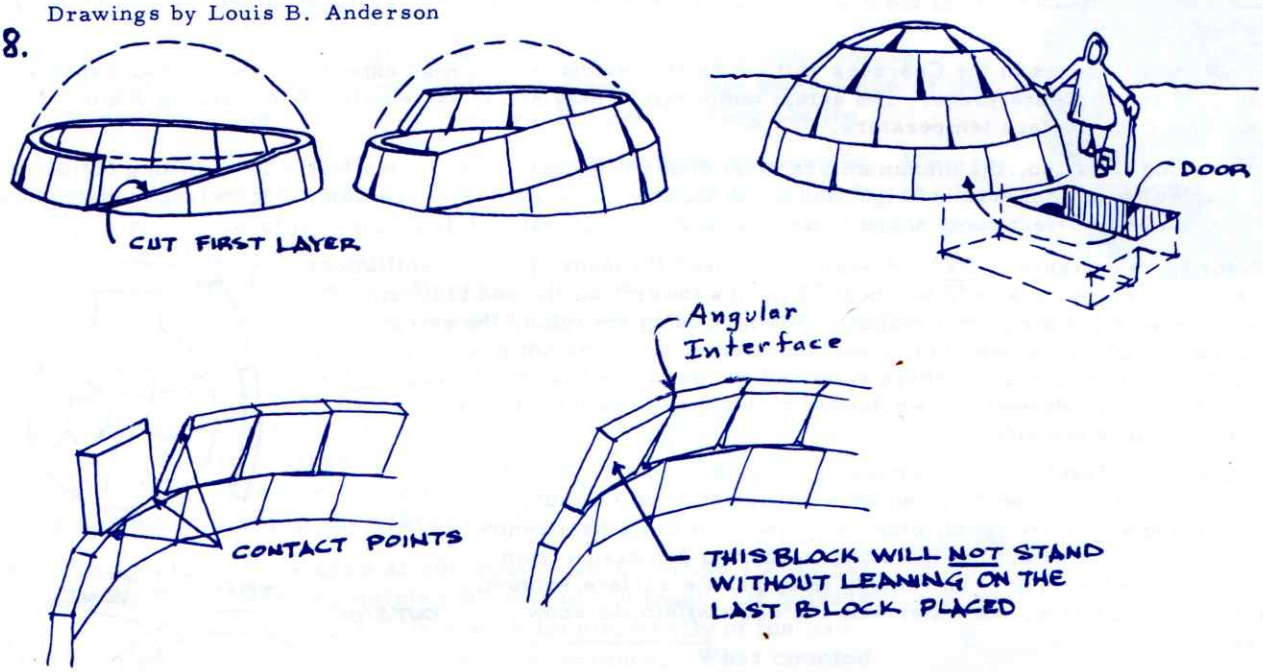
In very dry powder snow, someone told us to pile up a mound of snow six feet in diameter and six feet high. After waiting 20 minutes, the snow particles will have cohered to permit digging in and opening up a room. We haven't tried this; how well does it work? A reader says 20 minutes not long enough.

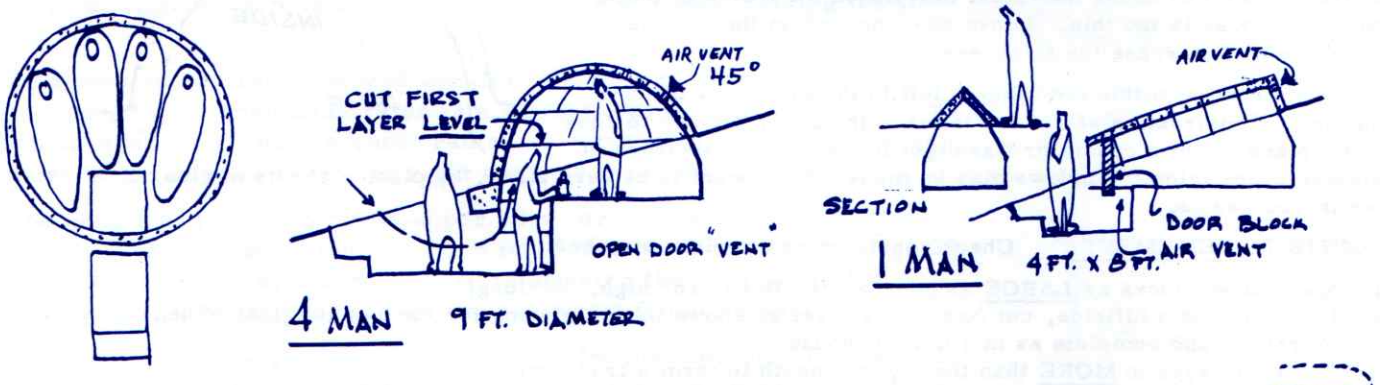
When the snow is very thin, roll up large snow-balls and slice them to make blocks.

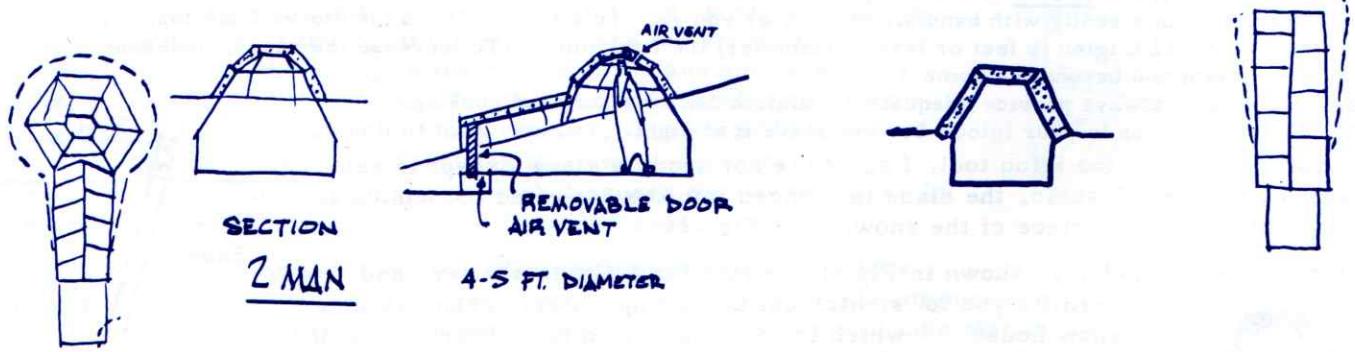
Don't forget the air vent in the roof. If snow is falling, check to be sure it stays open. An accumulation of 4% CO_2 causes headache, dizziness and vomiting. More causes convulsions.

Drawings by Louis B. Anderson

8.







May, 1970

CRAMPON CLOGGING

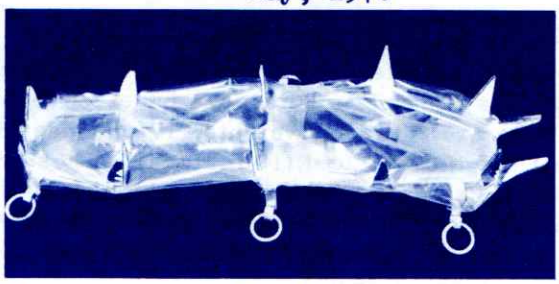


Fig. 20

Two weeks ago we climbed on Mt. St. Helens. At 7500 feet, I noticed that my crampons were clogging only occasionally, but those of my companions were clogging constantly. I raised the question and several companions obligingly sat down in the snow and held their boots up for inspection. The answer was immediately obvious. Snow had locked around the metal cross-bars of the crampon and in the cleats of the Vibram sole. It packed in just as a snowball packs hard in the hands with pressure.

The reason why mine didn't clog so much was also apparent. I was wearing nylon boot bags for warmth. The boot bags prevented snow from getting into the rubber cleats. But they did clog sometimes, and when they did we could see locking of snow around the cross and long bars of the crampon. Obviously boot bags were a help, but it took me until next morning to figure out the complete solution to the problem: wrap the crampon in plastic sheet. Fig. 20. This prevents the snow from getting either around behind the metal bars or into the rubber cleats.

I could hardly wait for the weekend to try out the theory. At Snoqualmie Pass, the idea worked perfectly. For four hours, I climbed with plastic wrapped around one crampon and nothing on the other. The plastic-covered one never clogged even once. The regular crampon clogged every minute or two.

The temperature was a little above freezing, excellent for making snowballs. We will report on tests in other snow next issue.

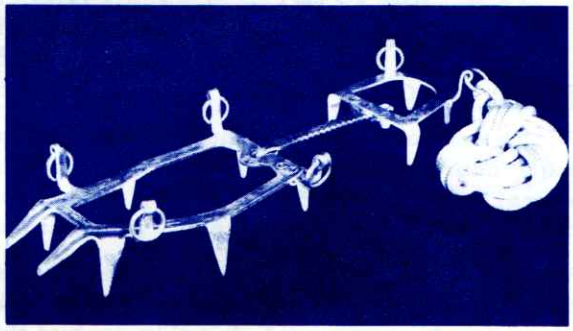
We have tried PE (polyethylene, regular plastic bag stock) and PVC and plastic-coated nylon cloth. The nylon cloth is far more durable, and should last a whole season. The PE tended to crack at temperatures below freezing.

Non-clogging nylon for crampons, 9" x 13.5" Item 83 pair $0.60
Holes are cut for the points and arms. The overlap and ends are closed with adhesive tape.

Why buy more than one pair? To give the other pairs to your rope companions, of course. Your safety may depend on their crampon security.

CRAMPONS -- SALEWA

Fig. 22



We are now selling the new model of Salewa crampons. The big advantage is that these crampons are adjustable both for length and width. A well-fitting crampon is a joy to use compared with one which is loose. Another advantage is that they are reasonable in price for an adjustable. Further, they have 12 points, which are helpful on steep slopes. Fig. 22. Note that there are four points which are crosswise, which helps prevent slipping when pointing the feet straight down the slope.

Plated to resist rusting. Special steel, hardened but not brittle. Lightweight, only 23 oz. per pair. Easy to adjust, wrench provided. We think you will like them. Send outline of boot for selection of size. Shipping weight 2 lb. Item 84 $17.15

Crampon Webbing

Non-stretching polypropylene, 3/4" x 96", with lacing instructions. Item 85 (pair) $0.85

Crampon Protector, 12-point rubber Item 86 (pair) $1.50

TEFLPAD. For skiing spiral fracture prevention. Ice sometimes freezes to the ski, making ice cleats corresponding to the grooves on the sole of the boot, thus preventing the boot from twisting out. The Teflpad, a self-adhesive film of Teflon, is adhered, slippery side up, to the ski under the sole of the boot. Any ice which forms cannot stick to the Teflon, thus eliminating interference with normal action of the toe piece. (Will not last long if you have metal plates on the bottom of your boots.)
Reference: Dr. John Outwater, University of Vermont. Item 49 $1.35

OUR NEW CLIMBING TOWER

Outside the Electromelt building is a 10-feet square by 40-feet tall steel tower, with stairway and platforms. We have converted it to a testing and climbing tower. There are two drop weights, 176 pounds (80 kg) and 220 pounds (100 kg), having a fall height of 33 feet (10 meters). These can be used for testing ropes, Auto-Belayers, belay devices and techniques, etc. The weights are lifted by an electric hoist. Six fixed-rope anchors extend out from the top for practicing ascending and rappelling. (A bed of wood chips all around the tower is intended to ease your stop if you lose control.)

Mountain Rescue groups may use the tower without charge. Others, $1 per person donation toward the cost of equipping the tower, each session of use, until paid for.

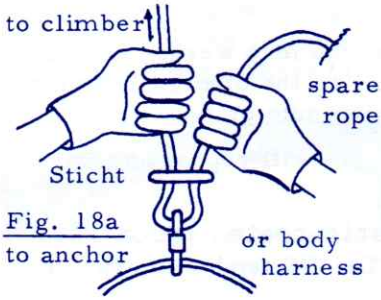


Fig. 18a

STICHT BELAY LINK. A simple belay system invented by Fritz Sticht and made by Salewa. Much better belaying power than a hip belay. A loop of the climbing rope is pushed through the opening in the plate. The loop is then engaged by a carabiner which is either attached to the belayer's anchor or to his waist if he is secure. Passing the rope out or in is normal for the motions of a hip belay, except easier. If the climber falls, the belayer pulls back with his hand on the free end of the rope, the plate snaps close to the carabiner, and friction on the rope is automatic, controlled by the friction of your gloved hand. This size for 11mm and 7/16" rope. With instruction sheet. Wt. 1.5 oz. Item 69---$.95 Instruction Sheet only, in german with english translation. Item 74--$.25 See Fig. 18 a & b.

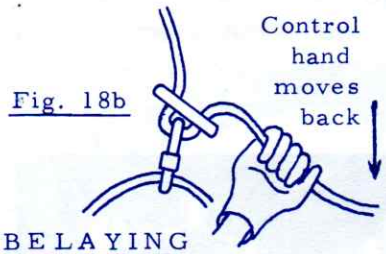


Fig. 18b

We have been disillusioned about the holding power of the sitting hip belay during instrumented drop tests. Practice sessions using long stretchy ropes, short falls, and heavy back pads may have misled you as to your ability to hold a fall with a hip belay. We recommend you buy a Sticht and actually practice holding falls of truck tires or concrete blocks. The next issue will be on belaying techniques around the world.

BELAYING

"Falls are fortunately rather uncommon, but unfortunately their very rarity makes climbers all the more poorly equipped to handle them. Some so-called experienced climbers have gone serenely on for years, without belaying properly, and, never having known the sudden terror of a fall, they have never considered the consequences." Mountaineering--Freedom of The Hills, page 147.

Amen! After reading "Belaying The Leader" and holding over a hundred instrumented falls, I agree completely. One hears stories of hard falls held with hands cut to the bone by the running rope, or with rope-burned backs, but this sort of thing isn't necessary any more. New techniques of absorbing energy have moved the hip belay to third choice.

1. Munter Friction Hitch

An Italian guide, Franco Garda, showed me a rope hitch on a carabiner which serves as an energy-absorbing friction system for effective belaying. We have held 25-foot falls of a 200-pound weight, with a stopping factor of 0.3. (This means that the weight was stopped while travelling an additional distance of 7.5 feet after the rope became taut.)

The Munter Hitch is shown in Fig. 17. The carabiner is best connected to a good anchor. Next best, to the seat harness if the belayer is secure. The rope can be passed both in and out through the hitch readily provided the rope isn't too stiff and isn't 3-strand twisted. The hitch inverts on change of direction.

EDMONT ROCK GLOVES. Light weight, very flexible. Vinyl impregnated for an excellent grip, even on clean, wet rock. Slightly porous for coolness. Saves many of the cuts and abrasions in general rock climbing. Also good on snow on warm days. Sturdy enough to save the hands when holding a fall, if taken through other friction. A pair lasts about three long days of climbing.

Medium, large, extra large Item 62 $1.30

1. Munter Friction Hitch (Cont.)

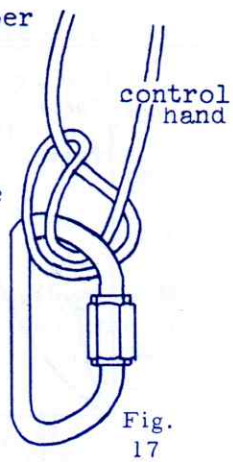


Fig. 17

At the time of a fall, it is only necessary to grip the free end of the rope with the gloved hand to accomplish up to say 500-700 pounds of restraint on the climber's end of the rope. The angle that the control rope makes with the climbing rope changes the restraint only a little.

Providing one is using a reasonably flexible braided rope, I consider the Munter Hitch the best way for a second man to absorb the energy of a fall of the first man. Wear on the rope for single falls is negligible.

2. Sticht Belay Link

The Sticht is also an effective way of absorbing the energy of a fall. It uses an anchored carabiner also. The climbing rope is doubled and pushed through the elongated hole in the Sticht. The carabiner is snapped into the loop of the rope. Fig. 18a. Passing the rope in and out is easy, much easier than when using a hip belay. Note that the hands need to be close together to avoid moving the Sticht close to the carabiner. When holding a fall, the gloved control hand is moved away from the rope going to the falling climber. The Sticht then snaps into contact with the carabiner and the rope takes three bends around metal. With a gloved hand, a restraint of 400-900 pounds can be achieved readily. The actual restraint depends on the size of the slotted hole, the size of the rope, roughness of the rope, and the restraint by the gripping hand. The 11mm size is suitable for both braided 11mm and twisted 7/16" ropes. In the next issue, we will have actual restraint figures for various ropes.

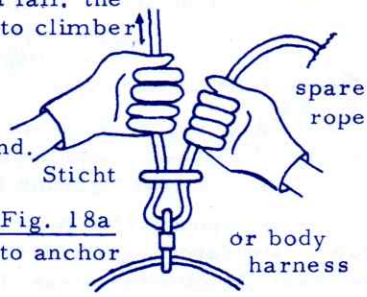


Fig. 18a

3. Sitting Hip Belay

In this commonly-used belay, the belayer sits in the best socket possible and is preferably anchored also. The climbing rope passes around the hips (often the waist). When a fall comes, the control hand on the free end of the rope is moved across the front of the body to increase the angle of wrap, and then (at least in theory) the control hand tightens on the rope. Fig. 19.

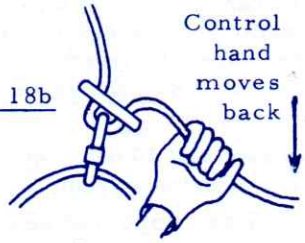


Fig. 18b

In a test setup, Oetzel and Gardner measured a peak restraint of only 300-400 pounds, with the rope running over a well-padded back, using heavy gloves. Summit, July 1969. Our slow-pull tests showed belayers collapsing with pain with a force of only 325 pounds, no pad except the single-layer of a cotton parka. When one remembers that the force of gravity on the climber (his own weight) must be subtracted from the above restraints, a fall of 20 feet would be stopped only with a slipping of another, say 30 feet of rope. This is too far. The total energy to be absorbed is too high and there is danger of hitting a ledge.

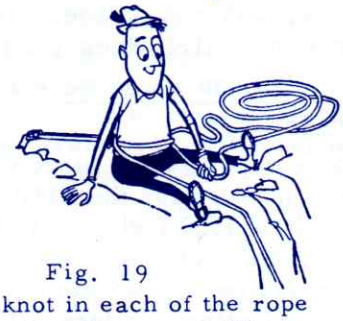


Fig. 19

STICHT BELAY LINK FOR RAPPELLING

At intermediate practice, the instructors tried the Sticht for friction in rappelling on one rope. It worked fine. We also have tried it, and like it as well as or better than a double brake bar. When going down on two ropes, use two Sticht's on one carabiner. But be sure to tie a figure-eight loop knot in each of the rope ends separately before throwing them down. Do not tie them together, to avoid a jam due to twisting.

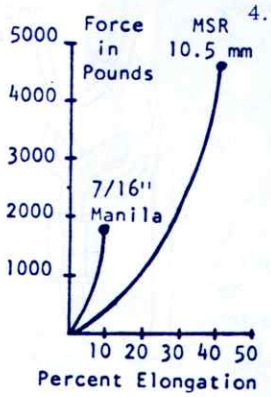
The friction given by the Sticht changes with the size, stiffness, and type (twisted vs. braided) of rope. Do any of our readers want to make a series of tests for publication? In any case, each person should practice with his own rope before going out in the mountains.

Effect of a Sticht on Strength of The Rope

We have not found any appreciable weakening of nylon rope by four falls on the same portion of rope. The rope does stretch, but shrinks back nearly all the way in a week or two.

The Sticht should not be used on 3 strand nylon or on manila rope.

MSR CLIMBING ROPE



MSR 10.5 mm climbing rope is braided kernmantel (core and sheath) construction. It is made of high tenacity, high softening point (430°F) nylon 707. It has good shock and energy-absorbing properties due to intentional and beneficial 15% shrinkage during manufacture which is available as stretch later without loss of strength during a fall.

The MSR-10.5 rope is a multi-fall rope, providing there is no obvious damage. After loading to 2640 pounds, its length restores in just a few minutes to the original within 5%. The internal strands are not damaged by repeated 2640-lb. loads. Ultimate breaking strength using P-H knots, 4600 pounds.

This rope is smoother than european kernmantel ropes a feature which is an advantage for lower friction through a series of carabiners, and a disadvantage when using the rope for hauling-up of packs by direct hand grip. A 6-ring prusik instead of a 4-ring prusik is required for more energetic climbers. The rope is also more flexible, having a stiffness factor of 60 as compared with 110 for certain european kernmantel ropes. Most people like this easier handling; some do not. The low-load stretch at 200 pounds is 6.5%, which is medium for climbing ropes.

The braid is longer, which makes the normal fuzz due to wear more apparent; the strength holds up well, because the fuzz protects the fibers underneath. Please note that life insurance premiums wear out and have to be renewed; the same holds true for ropes. 100 days of use is maximum.

Weight, 4.5 pounds/100 ft. Color yellow-orange, with red center and ends. 80, 100, 120, 150, 165, and 300 ft. standard lengths. Priced to all at wholesale, 17¢/ft plus $1 per rope uniform postage Rockies and west, $1.50 other areas, plus 4.5% tax Washington State only. Item 4-P .17 per ft.

Unprocessed Rope

You can also process your own rope by boiling it for 40 minutes, using Rit dyes in your own color combination. Unprocessed white rope, 11¢/ft, plus postage and tax. Weight 3.9 lbs/100 ft. Allow for 15% shrinkage. Instructions included. The processing is very simple, and is standard practice in the nylon industry. Ref: Handbook of Textile Fibers, Part 2, P. 268 and 294, by Cook (Merrow Publishing Co., England). Item 4-U .12 per ft.

We also sell 10 mm rope, same as 10.5 mm except: strength between P-H knots is 3400 pounds; the fiber is nylon 6 (same as perlon); weight 3.8 pounds per 100 ft. Unprocessed weight is 3.3 lbs/100 ft.

10.5 mm rope passes the UIAA test drop once, but not twice. See below for 10.8 mm rope which does pass UIAA test.

Item 3-P Processed .14 per ft.
Item 3-U Unprocessed .09 per ft.

NEW -- MSR 10.8 mm Rope with Controllable Stiffness

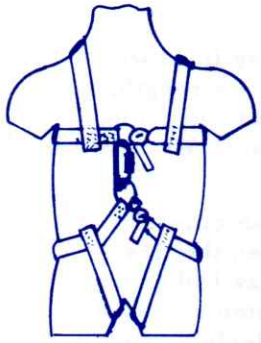
The new rope has 10% more weight than the 10.5 mm rope, and will pass the UIAA test. The UIAA test is a drop of 15.6 feet on a static anchor, weight 176 pounds, fall factor almost 2 to 1. The test calls for a minimum of two drops, and ours has taken five drops without failure. The stiffness of the new rope can be controlled by you: if you want a stiffness factor of about 70, soak the rope ten minutes in water at 150° F. If factor 100, 180°. If factor 115 (about the same as Edelrid and Mammut), near boiling. Dye can be added at the same time. Identified by red stripe. Braided core and braided cover, kernmantel type, Nylon 6-6. The elongation at rupture when boiled has been increased from about 33% to 43% between figure-eight loops. The figures over polished steel drums, as reported by some manufacturers, would be higher but not realistic for the mountaineer. ....

Unprocessed with simple instructions. Allow for shrinkage of 17%; order 73 ft. unprocessed for 60 ft. after processing; 146 ft. for 120 ft; 182 ft. for 150 ft; 200 ft. for 165 ft. Item 124-U--14¢/ft. 4.2 lbs./100 ft.

Processed by MSR, 100% stiffness, 18¢/ft. 60 ft, $10.80; 120 ft. $21.60; 150 ft., $27.00; 165 ft. $29.70 Wt. 4.8 lbs./100 ft.

SLING ROPE SET. Dacron braid on polypropylene core 1/4" diameter. One 9-1/2 ft. and one 10-1/2 ft. length. Excellent for Prusik and Ascender slings because of low stretch and high strength. 1700 lbs. test, P-H knots. Ends are melted. Item 1 $2.40

SLING ROPE. Same as Item 1, except ends must be taped and well melted by user over candle flame to secure cover to core. Any length. Item 2 (per ft.) $ .12



MSR BODY HARNESSES. A fall on a bowline-on-coil can fracture ribs and cause other body damage. The MSR harness picks up the impact on five major body points with 2" wide polypropylene webbing throughout, and gives you a better chance to survive. This harness design has been tested successfully on a 220 lb. torso dummy, and has survived 20 falls with peak forces up to 2700 lbs. Full strength stitching with Dacron thread.

The two parts of the harness can be closed with a strong locking-gate carabiner, such as Item 32, or by tying the climbing rope through both rings, using a high-security knot. Warning: do not allow climbing rope to run under high load across the harness. Use a brake bar for rappelling and a Sticht Belay Plate for belaying to take the high load off the body. More about the weld-abrade phenomena later.

Seat Harness only. Specify hip measurement.	Item 23-1	$4.95
Chest Harness only. Chest measurement under armpits.	Item 23-2	$4.95

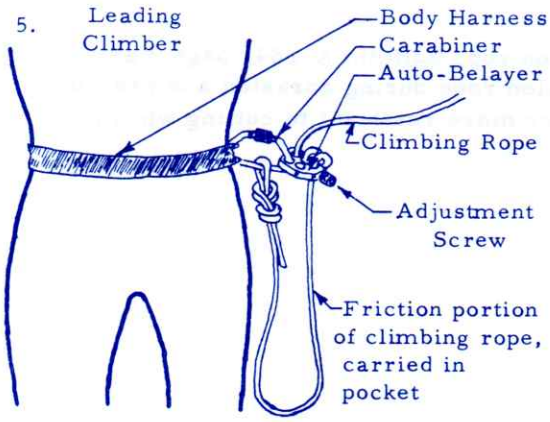
TIED HARNESSES. The sewed harnesses above are a bit more comfortable but tied harnesses are quite good and less expensive. The kit includes one piece of webbing for the chest, one for the seat, and two metal rings, with instructions for tying. A lock-gate carabiner, minimum 3000 lbs. test, such as Item 32, is required but not included. Specify large or medium.

Black, 2000 lb. test webbing	Item 24-B	$3.95
Red, 3000 lb. test webbing	Item 24-R	4.50
Lock-gate carabiner, Bonaiti	Item 32	2.75

WEBBING. 2" wide.

1 oz./yard, black, polypro, 2000 pound test	Item 42	per ft.	$ .11
1.5 oz./yard, red, polypro, 3000 pound test	~~Item 43~~	~~per ft.~~	~~.14~~
2 oz./yard, green, nylon, 3500 pound test	~~Item 75~~	~~per ft.~~	~~.16~~

MSR AUTO-BELAYER



At last you can be sure of a dynamic belay by carrying your own automatic belayer. Weight under 4 oz. The A-B is an aluminum plate 2" x 3" with holes, thru which 7 feet of the rope is threaded. A loop is tied in the free end of the rope and is snapped into the body-harness carabiner. The Auto-Belayer is also snapped in, with the 6 feet of rope stuffed into a pocket. If the climber falls, the 6 feet of rope is pulled out of the pocket thru the Auto-Belayer frictionally, thus absorbing the energy of the fall dynamically. The degree of friction restraint is adjustable by the climber, and is usually set for a pull-through force of 800 pounds. That force stops a climber in about one-third the distance he fell. When the peak force is thus limited to 800 pounds, there is much less likelihood that pitons will pull out. Patent applied for-Larry Penberthy.

Item 33 $5.95

MSR 10.5 mm ROPE

The braid construction used on this rope is called "tugboat braid". Tug boats require heavy lines which have good stretch, high strength, and flexibility. Previous ropes were good for stretch and strength, but very stiff to handle. This new construction was developed to improve the flexibility and easy-handling characteristic while retaining the strength and elasticity. The result was highly successful. We have applied this same construction to our mountain climbing rope.

However, the "tugboat" construction includes fairly long stitches, as compared to European climbing ropes. The initial wear produces a long fuzz that was disturbing to the tugboat crew. When the first trial rope of the new construction had been in tug service only one month, a pronounced fuzz had developed, and the captain predicted the rope wouldn't last three months. Instead, the rope lasted 18 months. The explanation is that the initial fuzz of the tugboat braid serves as a mantle over the underlying fibers and protects them from further wear.

This principle is recognized in the Edelrid rope booklet, page 20, as follows: Resistance to Abrasion "It has always been a problem to find a suitable method for abrasion tests. Up to this date a reproducible test method has not been found. All types of mountaineering ropes are subject to wear and tear, which, however, only affects the sheath of the Edelrid mountaineering rope, while the mainly load-bearing core remains undamaged. After a certain period of use the sheath shows a velvety "fur" which not only increases the good grip but also protects the threads of the undamaged braids lying underneath."

The way to judge when the MSR kernmantel (braid-on-braid) rope is worn out is to examine the strands with a 10-power magnifier, and estimate the proportion of filaments which are cut vs. those which are intact. When 60% of the filaments are cut it is time to get a new rope. At that time, the core still has a strength of 2500 pounds and the cover, say 500 pounds more. Reduced to 60% by the figure-eight loop knots, the net usable strength will still be in the range of 1800 pounds.

If you do not have a magnifier, melt back the fuzz over a 4" long portion by passing the rope over a candle flame. You can tell immediately whether the underlying rope is still sound and suitable for continued use. Since the long fuzz is necessary for long life, you should not melt down the fuzz over the entire rope.

We do suggest washing the rope whenever it gets dirty. The dirt comes out best when the temperature is held under 150°F. Reshrinking the rope for restoration of energy-absorbing properties is best at temperatures nearer boiling. You can also re-dye the rope to make it pretty again. "Rit" dye requires at least 150°F to "set" the dye.

In further support of the above, we quote from the Du Pont nylon rope bulletin X 184, page 3 as follows: "A protective shield of broken fibers forms on the surface of nylon rope during abrasion and prevents damage to the sub-surface fibers." The logic is: nylon is much more resistant to cutting when not under tension, and the fuzz is not under tension.

More on ropes in Issue No. 5.

CARABINERS -- Excellent

Our policy on carabiners will be to stock all light-alloy models that are marked with a strength rating, which have no design defect.

Bonaiti D-shape aluminum alloy, made from 12 mm rod, marked 2200 kg (4850 pounds) MSR test 5900 pounds major axis, 2600 pounds gate open, 2000 pounds minor axis. Each piece is tested during manufacture to 80% of rating. Wt. 2.7 oz. For heavier climbers. Only a few hundred left. Item 31 $2.50

Bonaiti, locking gate, same as Item 31 except 11 mm rod, 1800 kg (3960 pounds), MSR test 4800 pounds major, 1600 pounds open, 1600 pounds minor. The threads on the gate are raised, and are over solid metal (not drilled out). In this way, the strength is not reduced. This is good design. Wt. 2.2 oz. Item 32 $2.50

BONAITI Special: D-shape aluminum alloy. 11 mm diam. body, 12 mm gate. Gate closed, rated 4860 lbs., actual about 6000 lbs; gate open, actual 1800 lbs; minor axis actual about 2000 lbs. Each carabiner load-tested at 80% of rating. Wt. 2.3 oz. Item 127 $2.25, Five for $9.00, Ten for ~~$27.50~~ 17.50

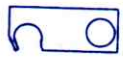
BONAITI UIAA: D-shaped aluminum alloy, 13 mm rod. Gate closed, rated 5500 lbs., actual about 8000 lbs; gate open, actual 2700 lbs; minor axis, actual 2300 lbs. Wt. 3.2 oz. Item 128 $2.50

Rescue Pulley, Magnusson type. Nylon wheel with side plates. 3900 pound test. Modified by MSR to include spacer washers for easier turning under load. Can be used with ratchet knot. Item 58 Wt. 1.3 oz. $1.95

Stubai 1800 D-shape aluminum alloy. 11 mm rod, marked 1800 kg (3960 pounds), MSR test 5400 pounds. Similar in shape to Item 31. Available end March. Wt. 2.2 oz. Item 77 $2.00

Stubai 2200 Forged aluminum alloy. Meets UIAA specifications, rated 2200 kg (4850 pounds), MSR test 5900 pounds. 3300 pounds open, 1700 pounds minor. Available end March. Wt. 2.6 oz. Item 78 $2.95

Salewa 2100. Forged aluminum alloy. Rated 2100 kg (4630 pounds), MSR test 6200 pounds. 3400 pounds open, 1300 pounds minor. Appearance similar to 78. Item 79 $2.75



Brake Bar, MSR, designed for Bonaiti Items 31 and 32, Bedayn, REI oval and D, CMI oval, Eiger oval, Stubai 1800, and Army carabiners, for easy rappeling. The hole is large enough to permit the bar to go around the corner of the carabiner to make use easier and more certain. The metal at the open end can be bent (gently) to adjust for a snap fit, if desired. Two of these bars can be used, facing oppositely, on one carabiner for more friction on a single rope. Test over 3000 pounds. Wt. 0.7 oz. Item 27-T $1.95

Descending Rings, steel, 1.3" inside diameter, 1/4" rod, logging chain quality welding, 3500 pounds test, chrome finish. Also useful for tied body harnesses. Wt. 1.1 oz Item 35 $ .25

CARABINERS -- Dangerous For Climbing

We have tested many dozens of carabiners, looking particularly for dangerous ones. We found some:

Kamet, which has only slanted faces at the gate, Fig. 14. The gate of this carabiner pulls out in minor axis loading at only 275 pounds! Several climbers have reported narrow escapes from serious accidents when this has happened in use. Reference: National Speleological Society News, Sept 1969. (There are other carabiners that have only slanted faces at the gate. Watch out for them; they are to be used only for decoration to impress the tourists.) The locking type is little better. The threads are cut so deep in the gate that the gate breaks in the center at only 550 pounds.

Fig. 14

Recreational Equipment Orange Oval Safety model. Several thousand were sold in 1968 and 1969; sale was stopped in June 1969. The threads are cut so deep that there is little metal holding the pin. Two we tested broke at 1550 and 1600 pounds, and one tested by Seevers & Horn (Summit June 1969) broke at 1300 pounds. Others broke at loads up to 2000 pounds, but this won't help you if you have one of the weaker ones.

Unmarked Steel, dark gray-brown color, 89¢ in the 1969 REI catalog. There is a hidden design defect in the hinge. Broke at 1300 to 1700 pounds.

Fig. 23

MSR PACK

I needed a new pack. After looking over available models, I figured we could do better. We designed a pack, had it built, Fig. 23, used it for six months, and think it is just fine. We think you will like it, too, so we are adding it to our line. The safety aspect is to keep you in better condition by relieving back ache and shoulder ache, and to avoid having to pull everything out of the pack to get at something on the bottom.

Frame

The frame is aircraft quality aluminum tubing, free of welds. The cross bar, to which the shoulder straps are attached, is adjustable in height, over a span of 7 inches, for individual comfort. The top bar is removable.

Back Pads

Instead of only 2 or 3 back pads, this frame has 50. They are 1/8" braided nylon cord. Such back comfort you wouldn't believe until you try it for 3 hours with a heavy load. The idea of using many 1/8" cords to contact the back is old; I have used one for 20 years. Strung packboards went out of style only because of cost. Stringing the frame in the factory raises the price because of the handwork. But you can do the job easily yourself in 30 minutes and save money. Fig. 25

Bag Design

The bag is an important innovation. The entire back panel zips open! Fig. 24. Lay the pack down, unzip the panel, and you have quick access to items at any location. No more having to pull everything out of your pack to get the rescue pulley, for example, which worked its way to the bottom. This is a real convenience. Items can also be stuffed into the pack while it is on your back by unzipping only the top edge.

The very large side pockets have the same feature. They can be opened full length when the pack is lying on the ground, and everything can be found without lifting other things out. They can also be opened across the top while travelling, to get out gloves or water bottle.

Fig. 24

Bag Size

The bag is extra large, 15" wide x 24" high x 12" deep, so you can put everything inside except a bulky sleeping bag. The external side pockets are 2-1/2" x 5" x 21" each, to hold all your small items. The material is red waterproof nylon.

Adjustable Bag Height

My own preference for load height is to have the center of gravity of the pack even with the center of gravity of the body. This keeps body balance reactions the same. One leans forward quite naturally until the combined center of gravity is directly over the hip joints, and motion is most natural. But you have the choice. If you want the bag higher, simply pull the 6 pins and shift to higher holes in the frame, at 4.75" and 9.5" intervals.

Load Compressor Straps

When carrying less than a full load, the three load compressor straps are pulled up tight to hold the load higher and close to your back, and the top bar is removed. Hence, you need not worry that this pack might be too large for your needs. The strap also holds the ice axe and crampons if you want to carry them outside.

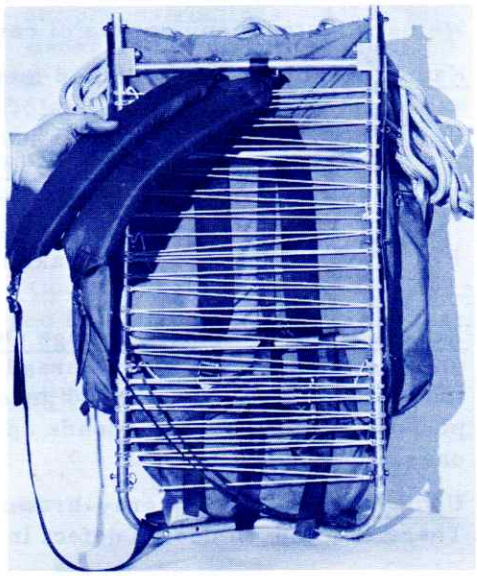


Fig. 25

Shoulder Straps

The shoulder straps are the new style with 3/4" latex foam sewed inside the tubular nylon cloth. Latex is an excellent material because it accommodates to the shoulder bone for reduced unit pressure. The pads are long enough to come down all the way in front of the shoulder, which helps to bear the load. The buckles are just in front of the armpit, and are easy to adjust while hiking. You will find that you will be adjusting them several times an hour. The lower end of the straps go nearly to the bottom bar of the frame for decreased tension and ease in getting the arms in and out.

Rope and Sleeping Bag Straps

Straps are provided for carrying the rope in the open across the top of the pack. This would be done when the rope is wet or will be needed soon. Personally, I always strap the rope on the outside like this, hoping that someone will volunteer to carry it for me. I am pondering why this hope is the only feature of the whole pack that doesn't work very well! The straps are long enough to hold a large sleeping bag also.

Zippers

The zippers are heavy-duty nylon-coil type, which operates smoothly, resists freezing, and never corrodes. Two sliders are provided on each zipper for convenience in opening the part which is wanted. The pull tabs are large and semi-swivel for ease of operating with gloves.

Summit Pack

The shoulder straps are shifted to the bag to permit the bag alone to be used for a summit pack. Fig. 25. The bag is easily removed from the frame by pulling the pins. The load-compressor straps across the back are then tightened to make the bag compact. Safety Note: You can put your feet in the bag for warmth if you are stopped overnight.

Special Note: We believe that all summit packs should contain a Storm Shelter (Plastic Tube Tent) such as made by the Tacoma Mountain Rescue Council, our Item 46, page 2-3, $1.00. For 5 ounces, they are marvelous for warmth. Worth putting on during lunch stops in bad weather to stop wind chill.

MSR Pack, including Frame and Bag. Back cords are strung and ready to go. Net weight only 4 lb. 1 oz.
Shipping weight 6 lb. Item 90-S $49.50
Same, except cords are not strung. With cord and instructions. Item 90-U $45.00

Hip Belt

The hip belt concept is excellent for avoiding aching back and shoulders. Our design has a 2" webbing belt that goes around the waist, and is cone-shaped for comfort. The load straps attach at each hip and extend down to the bottom bar of the frame. This arrangement gives the least constriction of the tummy. Both the 2" belt and load strap have quick-adjustment buckles. Ethafoam pads provide cushion over the hips. We strongly recommend this item. Picture in next issue. Can be used with other pack frames also. Net weight 7 oz. Item 89 $4.75

MSR

MOUNTAIN SAFETY RESEARCH

NEWSLETTER

MSR

Published by Mountain Safety Research, Inc.
631 South 96th St., Seattle, Wash. 98108 - USA
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European Branch: 35 Progress Road, Leigh-on-Sea, Essex, England

Issue 4
FEB. 1971

Greetings & Happy New Year! Response to the Newsletters has been enthusiastic, and distribution has risen to 7843 direct mail plus 1200 in bulk to clubs. The last issue was in May, and now readers are writing to ask where is the next one. Sorry for the delay. There were many reasons: we had an excellent climbing season, which wiped out my summer spare time; development of new ice axes; a surge in the glass engineering business which required me to go back to work instead of just having fun with MSR; testing of new products put on the market by others; travel to mountaineering meetings abroad; and election to the Board of Trustees of The Mountaineers, which is one of our arenas and which takes time. More about these in this issue and later.

NEW MSR ALL-METAL ICE AXES

$19.95 less immediate Patronage Dividend of $2.00, Net Price $17.95, includes adze guard.

Uniform postage 75¢ west of Mississippi, $1.15 east, plus 5% tax Washington State only.

CHROME MOLY steel heads heat-treated
High-strength ALUMINUM ALLOY tubular shafts.
High-strength spike design, with no ferrule joint.
Both head and shaft coated with Neoprene-base for grip, heat insulation, and orange color. Light weight, one pound twelve oz. (790 gm) 32.5" length.
lengths: 22, 26, 29.5, 30.5, 31.5, 32.5, 33.5, 34.5, 35.5, 36.5, 37.5 inches.
Supplied with glide ring and wrist strap. Polished heads on special order, $5.00 extra.

Item 101

THUNDERBIRD*--Amazingly effective for chopping steps in ice. Excellent for self-arrest on hard snow and ice.

Item 102

EAGLE--Excellent for self-arrest on hard snow and ice and as ice dagger. Chop with adze

Item 103

ST. PARBAT--Similar to Nanga Parbat of Stubai, Everest of Ralling, and others.

Teeth on St. Parbat are standard, because the hooking capability depends on them. Teeth on Thunderbird are not wanted, because they make the pick stick too much in hard snow. Teeth on Eagle are available at $1.00 extra.

Please improve your safety and order guards for your axe. Soft rubber.
For all spikes and for picks of Eagle and St. Parbat. ---- Item 130--40¢
For pick of Thunderbird. ---------- Item 131---50¢
For adze of all axes; leave guard in place in self-arrest. Item 132--50¢

HERE IS THE STORY

Background

We tried hard to get the well-known ice axe makers to improve the strength of their shafts. The uptake of our proposals was underwhelming. We then tried to buy heads, planning to shaft them with our own aluminum tubes. The makers were willing to sell heads only, and we did get a few in June-July 1970 from Stubai; but the few we could sell would not meet the general need for stronger axes for all climbers. The main production of the old makers would still be the same old wood that breaks. Further, the prices were high and deliveries too late to meet the 1971 season. We couldn't continue with the stainless steel heads; they were so costly that we could not reach the general market with them. In desperation, then, we turned to another process and found to our joy that it gives a superior product at low tooling and labor costs with short production time. Best of all, the new process is versatile, and it was possible to make improvements in design at low cost quickly.

MSR Process for Axe Heads

The new process is simple. The pick and tang portions are flame-cut as one piece from 1/4" plate, and the adze is stamped from 1/8" plate. The two are welded together by the TIG (Tungsten-inert gas) process. The steel is chrome-moly Type 4130 including the weld metal, the same as used in pitons and aircraft. The final shaping and finishing are done by conventional milling, grinding, and drilling.

Axe Head Design

Our initial thought was to make a reliable axe that would have excellent self-arrest capability on hard snow and ice, which would cut steps with the adze, but not with the pick. This axe head was named the EAGLE. It has a good hooking angle, 68°, and has a 30° included-angle point. Its main use will be for ice climbing specialists.

Suddenly, while testing the Eagle, came the dawn! By lengthening the radius of the upper edge of the pick, retaining the same hooking angle of the lower edge, the pick could also be used for cutting steps In appearance, the upper edge and the lower edge of the pick diverge as they approach the point. By providing positive clearance of the cutting edge, self-arrest capability is retained. This is the design concept called THUNDERBIRD. Fig. 26.

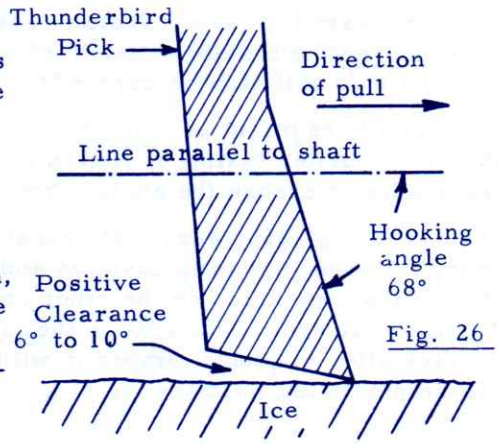


Fig. 26

Field testing quickly showed the THUNDERBIRD advantages. Kick (bounce, vibration) is gone! Steps can be cut with greater precision, both with the pick and with the adze. When cutting with the pick, the ice chips spurt to the right and left, not into your face. There is less tendency of the ice below the step to flake out because the splitting force is uni-directional, not 360° around the point. Excellent hooking power is retained.

This name, Thunderbird, comes from its resemblence to the beak of mythical thunderbirds on the totem poles of Western American Indians.

We think the Thunderbird axe is the best axe in the world today, and we recommend it for general climbers as well as for the experts. We offer you a money-back guarantee; if you give one a good trial and don't like it for any reason, send it back and we'll return your money plus postage both ways. Or you can trade it for a St. Parbat, but see comments under "Vibration".

MSR Process for Shafts

All MSR axes have aircraft quality aluminum alloy tubing as the main element. We chose this material over fiberglass for one basic reason: when fiberglass is overloaded, it breaks; when our alloy tube is overloaded, it only bends. MSR shafts are six times as strong as the weakest ash, and 2.3 times as strong as the best hickory.


Fig. 27

One end of the metal shaft is swaged down to 3/4" to receive the spike. This avoids a joint, which, in wooden shafts, is a weak point. The spike is made of cold-worked steel which has less tendency to skid on rock when the axe is being used as a cane. In time, the point will wear. Then it can be ground to a sharper point or it can be replaced by cementing in a new one. The other end of the shaft is formed down to a slot 1/4" wide to receive the tang, which is 1.2" wide by .25" thick. The tang is pressed in, a hole is drilled through for a stainless steel rivet, and 15 grams of epoxy are poured in to fill the spaces. This makes a joint so strong that we have not been able to make it fail. Some other part of the axe bends first. We are working on an invisible variation of the rivet which will be just as strong and lower in cost.

Some climbers have inquired about the cooling effect of the aluminum on the hands. We coat the aluminum to provide thermal insulation and to eliminate the slipperiness of bare aluminum. The new neoprene coating works well, and costs less than the fiberglass used last year. If anyone wants more insulation, the shaft can be wrapped with adhesive tape where needed. As a practical matter, the bare metal of the head has been cooling hands for a long time. We are coating the center part of the head also. This adds insulation, improves the grip, and reduces the cost due to omission of finishing under the coating. The new coating is tougher than the old fiberglass coating. In time, if it is marred by scraping on rock, the scratched places can be repaired with the same material simply by painting it on. We will offer this material in small cans later.

MSR Process for Shafts (Cont.)

Speaking of bending without breaking, you will be interested in the following incident which happened last summer. A climber set up a boot-axe belay, using an axe which we had reshafted with metal. He could get the axe only half-way into hard snow. The leading climber fell, and was caught on this belay. The rope rode upward to the head, the shaft bent 45° but did not break, and the belay held. Since the place where this happened was precarious, the belayer cheerfully paid to have another metal shaft put on. He was confident that a wooden shafted axe would have broken, with disastrous consequences.

COMMENTS ON THE THUNDERBIRD AND EAGLE IN SELF-ARREST

The hooking (or digging-in) capability of the Thunderbird and Eagle picks is so good that the next question concerns the strength of the bent fingers and arm to carry the load. Stewart Ferguson, Seattle, gave us this tip several years ago. Bring the wrist loop up over the top of the axe head to the wrist. Fig. 28 Then, if your fingers pull out, the load will still be carried by your wrist and arm.

Fig. 28

Some climbers might be concerned that the Thunderbird has too much hooking ability. After testing it yourself, you can always grind or file away some of the lower edge to change the angle. You may even want more hooking ability.

The "book", p. 255, says that arrest on ice is very difficult to impossible. We are trying to make it readily possible and are studying new ways of transferring the load of a falling companion on the other end of your rope to the snow and ice without going through your arm. The hole in the pick is for attaching the free end of the rope to the pick after you have clipped in with a figure-eight loop to your harness. If you will help with the field testing of such techniques, please write for the diagram.

VIBRATION = KICK = BOUNCE

When the pick or adze strikes ice or hard snow, there is a sharp reaction on the hand, called, vaguely, "vibration." One old-timer said to us, "You can't have metal for shafts; you've got to have wood to absorb the vibration!" His remark started us on a study of "vibration." What is it?

We began by striking various ice axes at 500 pound blocks of ice kindly donated to the cause by Dutch Gray at Rainier Ice & Cold Storage. It quickly became apparent that "vibration" is really a kick longitudinally of the axe shaft, and that the material of the shaft made no difference. What counted was the geometry of the pick and the angle at which it was striking the ice surface.

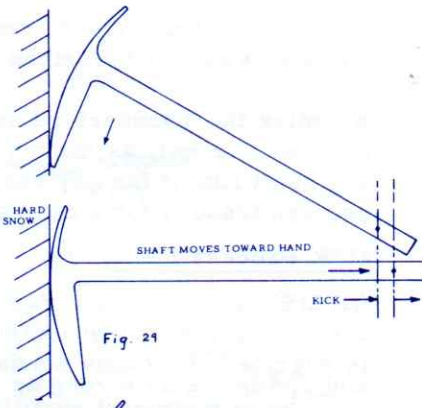
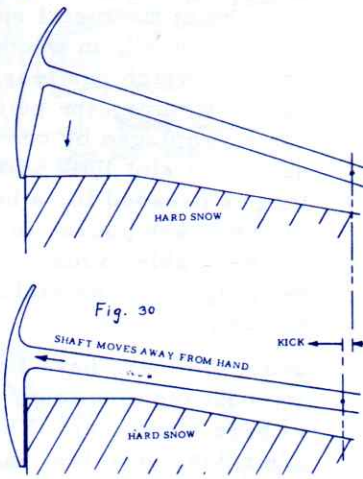


Fig. 29

Fig. 29 shows one extreme, where the axe is striking the far side of a step being chopped. The head illustrated is a Parbat shape, which is a term we apply to all axes which have a short radius of curvature on the upper edge, and whose lower edge is nearly at right angle to the shaft.

It can be seen that the hump of the upper edge forces the axe toward the hand as the swing is completed; the hand feels this as "vibration." Fig. 30 shows the other extreme, where the axe is striking the near wall of a step being chopped. Here the kick moves the axe away from the hand.



You can measure this kick in any axe by the following method: Tape a piece of string to the side of the shaft at the place where you grip when chopping. Stretch the string tight past the tip of the pick. Mark the string at the upper corner of the tip. Swing the string to the center of the axe and note how much metal there is above the mark. This extra metal is what causes the toward-the-hand kick. In the Stubai Nanga Parbat, there is 1/4" too much metal for a 28" radius of swing. Repeat for the lower corner of the point. The excess metal below the second mark is what causes the "away" kick. In the same axe there is 1/2" too much metal for a 28" swing.

Measuring is a little complicated with the Aschenbrenner and the Wallner patterns of Stubai. On these the edges near the point are tapered. The amount of kick is related to the metal that would be there if the tapers were continued. Engineers will note that the diagrams show the extremes, and that there is one intermediate angle of strike where the toward and away kicks are balanced

The essential difference between picks of older design and the Thunderbird is that the upper and lower edges of older designs converge as they near the tip, whereas in the Thunderbird, they diverge. This divergence is why there is no "vibration" with the Thunderbird axe. The material of the shaft has nothing to do with it.

OTHER PHENOMENA IN ICE AXE DESIGN

While testing various axes in the field, we noticed some peculiarities. I was using a Hope Alpinist axe on a small ice wall. At the top, I socked the pick into the hard snow to use as a hook for pulling myself up over the edge. To my consternation, the pick came out of the snow and I nearly fell off. The lower edge of the pick had no teeth, and the hooking angle wasn't sharp enough. ... When a pick does not have teeth, it will come out of the snow when the hooking angle at the tip is greater than 78°. The Alpinist has an angle at the tip of 84°, curving to 89° near the shaft. When I got home, I filed 4" of teeth in the lower edge. ... To help you check the hooking angle of your own axe, we have drawn a 78° angle at the bottom of this page. Cut a larger piece of stiff paper to match this angle, and then compare with your axe. If the angle is greater, better file in at least 2" of teeth.

The Nanga Parbat has a hooking angle of 84° near the tip, curving to 87° near the shaft, and has five inwardly-cut teeth. When used as a hook, the Nanga Parbat rises out of the snow part way until the teeth engage. Unfortunately, this leaves only part of the pick in the snow, resulting in reduced holding power. The Ralling Everest has teeth which project from the lower edge, and is much better in this respect.

This tendency to rise out of the snow, when the shaft is pulled, is also of interest in self-arrest. I know the book (Freedom of the Hills, p. 255) says you are supposed to lift the spike end of the shaft off the slope, changing the angle at which the pick meets the slope until it can begin to dig in. But did you ever actually accomplish this? Remember that you are lying with your chest on the shaft. Try this maneuver out on the lawn, and you will see what we mean.

Fig. 31.

Fig. 31 Self-Arre
from "Freedom'

I had never used a Nanga Parbat until this study, hence was startled to find that the pick ejects from hard snow when the shaft near the spike is pushed toward the snow. Try it for yourself. This is due to the strong curvature of the upper edge. Fig. 32... By now you may be wondering why we are offering a Parbat shape at all, when we don't have any compliments to say about it. Good question, and I have a tough time answering. Mostly, it is for climbers who want to continue with the more familiar shape of pick but who want a strong reliable shaft. For them, we also offer the Stubai Wallner head at $18.75, which we will make up on order. See page 3-4 (Issue No. 3) ... Actually we have made some improvements in our St. Parbat version over the Nanga Parbat of Stubai. The tip of the pick has positive clearance and will not skate over hard snow and ice in self-arrest; the teeth extend 2" from the tip, instead of 1-1/8"; the teeth are projecting, instead of inwardly-cut; and the adze of our version doesn't have so much droop and will cut steps without much kick. Further, we have given it a spiritual name. In any case, the price is low and you can afford to buy a Thunderbird later ....

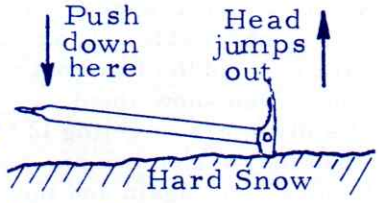


Fig. 32

The end of the pick of some axes comes to a sharp point. When cutting steps, we observed that such points exert a force in the ice in all directions around the point, which makes the direction of fracture less predictable. The ice below the step will sometimes flake out unintentionally due to such non-directional forces. Practice in directing the blows can minimize this problem.

The most startling phenomenon we discovered in certain older ice axe designs concerns the ice-skate action of the tip of the pick, described on page 4-6.

ICE SCREW WARNING

Paul Ledoux, Jr., MIT, Cambridge, has written a warning about breaking of Charlet-Moser ice screws. He set a brand new one in hard water ice and the shank broke off at the threads. Luckily, he felt it break and replaced it. However, Doug Robinson wrote in "Mountain 11", Sept. 1970, pp. 24-26, about a similar break, except the break was not detected until his second retrieved the screw. Luckily, Doug did not fall. ....

Several climbers in Europe told me about the breaking of Stubai ice screws of the same type (corkscrews) When I asked Stubai, they replied that they get reports of "only 4 or 5 a year." *.... Questions: Why do manufacturers continue to sell such equipment? Why do retailers continue to handle it? Do climbers continue to use it because they haven't heard of this unreliability? Pass the word around.

78°

* The climbers said, "More, many more break".

NESTER "SUPER-SCREW" ICE PITON

This newly-advertised ice piton appears to have some problems. We tested three for hardness and ductility. The hardness was Rockwell C 46-47, 39-44, 36-39. (All sub-surface readings.) The ductility in simple bending to failure was 6°, 8°, and 15°. In our view, the hardness spread is too great. 46-47 is too high for a part as severely notched as this. (All pieces broke at the root of the threads.) The ductility is not good enough to handle the problem if the surface layer of ice is softer than the interior, and thereby transfers the load to the threaded portion. Note that our tests were made at room temperature and that the ductility would be poorer at lower temperature. Neither the manufacturer nor Recreational Equipment, Inc. has made measured load tests on these pitons, and therefore we suggest that you not test them either if your life is at stake. Better stay with Salewa Tubular ice screws **until test results are published.**

SNOW SHOVEL WARNING

Three readers have reported that Recreational Equipment, Inc. has been selling a Parsenn Snow Shovel (Swiss) that breaks during the first use. The spot welds are defective. Growl: Why should it be left to the customer on the mountain to discover such defects? What happened to the eight-man advisory group REI bragged about at the September meeting? I went to the REI store today and found they are still selling it in spite of the complaints. Never mind, the Conditions of Sale on p. 41 of the 1970 catalog says that if you return a defective item unused within 30 days they will give you another one just like it. Free. The one that Bob Swenson, Sumner, Wash , got at REI broke in his pack, unused. He wouldn't take another from the shelf. He made them put in four rivets first.

RECREATIONAL EQUIPMENT INC. ELECTION

As you will recall from Issue 1, I got started in equipment testing on request of The Mountaineers Climbing Chairman in March 1968 to learn why four 3/8" Goldline ropes from REI had broken in snow practice. REI hadn't found the answer. I did find the weakness of the orange oval "safety" carabiner. Lloyd Anderson and Jim Whittaker saw the demonstration where a 200 lb. dummy falling only 36" broke this carabiner, but refused to take it off the market. The club published a warning. Seattle Manufacturing Co. (about 5 employees, owned half by Jim Clark and half by Recreational Equipment itself) replied with a letter to The Mountaineers threatening "actionable trade libel." I responded with a formal complaint to the Federal Trade Commission. The FTC forced REI to stop sale and manufacture of that carabiner.

Next I tried to build a fire under REI on the weakness of their ice axe shafts. When Derek Rouse (June 1969) took back his nearly-new axe which broke while he was hanging from it in crevasse rescue practice, the response was, "No adjustment, that's just the breaks of the game.", and they continue selling unreliable new axes. .... In May 1970, I noticed they were selling a low-elongation rope (Braided Goldlon) without warning that a climber would get a helluva jolt if he fell on it. In fact, they didn't even know about it. They were just selling it. They continued to offer it even after my warning at a directors' meeting 12 May 1970. .... They put SMC stamped rings on the market without test. Then they tested two and published 3900 pounds. I objected; they tested ten and published 2400 pounds. I objected again and they published 2195 pounds. .... They made a mistake in quality-control of the liners of sleeping bags, changed to sewn-through construction, and sold 600 cold-sleeping down sleeping bags without warning to the buyers. .... SMC made and REI marketed a new line of angle pitons without metered testing. The grain of the metal was across the axis of the piton. I objected. Their lawyer threatened me with civil suit for defamation of property. I replied with another formal complaint to the FTC for false and misleading advertising. .... Management of REI practically ignored the resolution passed in June 1969 "to institute and maintain an effective safety equipment testing program." When seven of us climbers went formally to protest at the board meeting in May 1970, we got nowhere. In June 1970, we submitted a valid call for a members' meeting. They defied us to go to court to get it. The following week they changed the by-laws to make it nearly impossible to get any matter brought up by members only to a vote of the entire membership. .... In September 1970, we formally asked that a quality-control engineer be employed. Nyet.

This section regarding REI was written in January, 1971. Lloyd Anderson had just retired and Jim Whittaker became General Manager. Now, in July, 1971, the attitude has changed decidedly for the better. See Issue No. 5 for more news.

Why are they still selling the same old unreliable wooden ice axes? .... In last year's catalog, they advertised their vinyl rain garments with the word "Flammable." This year they said they are going to sell the same items, deleting the word "Flammable." Regardless of flammability, the Mountain Rescue Council pointed out in their movie, By Nature's Rules, that these garments shred in the cold and wind. Why do they insist on selling such junk? .... In late 1970, we circulated REI Dissatisfaction Forms; over 100 complaints came in. (If you want some of these forms, send a self-addressed stamped envelope marked "REI Forms."

The point of all this is that management has told me that they are "merchants." It appears that a majority of the present directors go along with that policy. Sales go up every year, everything is OK. But a fatality due to failure of their equipment could result in a lawsuit that could result in a judgment equal to the entire net worth of the organization. We feel that some directors are needed who are oriented toward consumer protection. For this reason we ask you to vote for:

> LOUISE MARSHALL, Editor of Signpost Magazine for hikers and backpackers; chairman of the Trail Group of The Mountaineers; a strong conservationist; a consumer-protection advocate.
>
> DAVID MISCHKE, engineer; active in rescue; climber, skier, and caver; member of The Mountaineers and Sierra Club; also a strong conservationist; active in equipment testing; author of a coming article on dynamic testing of climbing ropes.

Louise and Dave are in no sense MSR candidates. They were each nominated and endorsed by 60 widespread members of REI. We think they will do a better job of policing the merchant attitude of the management than the other candidates, and we hope you will vote for them. .... In 1962, President Kennedy proclaimed the consumer's Magna Charta: 1. The right to safety; 2. The right to be informed; 3. The right to choose; 4. The right to be heard. .... Readers, make your views known.

POSITIVE CLEARANCE OF THE TIP OF THE PICK OF ICE AXES

We have been bothered by a series of separate accidents where self-arrest was inadequate on hard snow and ice. .... Accident one: Dr. Gene Mason told of the wild slide of his rope team 400 feet down an ice slope on Kilimanjaro, with self-arrest not working. .... Accident two: Chris Marshall, survivor of a rope team of three Mountaineers that slid at high speed 1000 ft. down Winthrop Glacier and fell into a 110 ft. crevasse, said that he was in self-arrest at the beginning, and that the self-arrest did not hold. .... Accident three: Another Mountaineers rope team of three fell into College Crevasse on Mt. Baker, each in turn. Witnesses report that the last one to be pulled in, the climb leader, was in self-arrest unsuccessfully. .... Suddenly in the midst of comparative testing of new ice axe shapes, we became aware of the importance of positive clearance of the tip of the pick for digging-in power on hard ice; and realized that the tip of some axes acts as an ice skate!

Fig. 33 shows the Stubai Nanga Parbat pick, which has a 10° negative clearance. Such an axe will ride over the ice, in self-arrest. As in the cigarette warning, this could be hazardous to your health.

Fig. 34 shows our suggested improvements for this and similar axes: change the tip from negative to positive clearance. While you are at it, cut in more teeth. This can be done with a sharp, medium-cut file, using slow strokes with very light oil or kerosene as a lubricant.

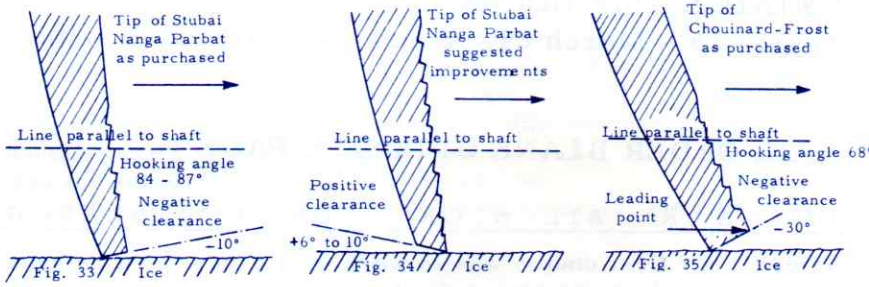


Fig. 35 shows the Chouinard-Frost pick with an excellent hooking angle but severe negative clearance. The desirable hook cannot come into action if the ice is so hard that the leading point doesn't get under the surface. The suggested improvement is to change the clearance from negative to positive as in Fig. 34. The hooking angle is already so good that more teeth are not needed. .... But remember that these axes have wooden shafts which may or may not be strong enough for boot-axe belay. Better fiber-glass them or change to a metal shaft. .... Many axes have a sharp point, and hence the clearance is very good. Further, both clearance and hooking angle are not important if the snow is medium or soft.

SLEEP

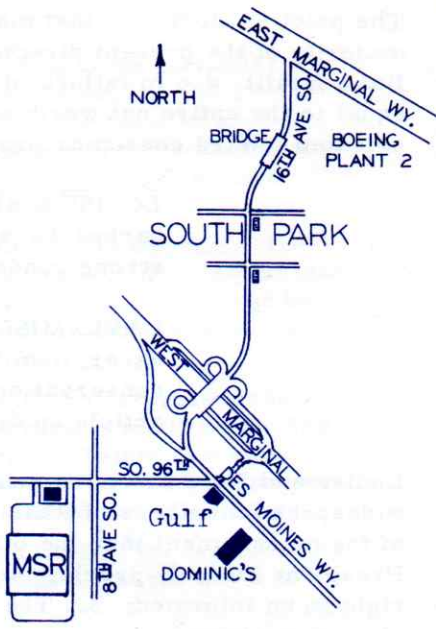
Reasonable sleep the night before is a factor in safety and performance during the day. Several of the medical kits list Doriden for sleep. But it made me excessively dizzy, with a head buzz (more than normal I beat you to it). Dr. Joe Eschbach, active in Ski Patrol, prescribed Placidyl, which works much better, and fades after about 5 hours. Better get the child's size 200 mg capsule, or even the 100 mg size for persons weighing near 100 pounds. The adult size, 500 mg is more than usually needed. Dr. Gene Mason warns to avoid Nembutal, Seconal, and the other barbituates; their effects linger too long (morning hangover.)

HELP!

14,000, July, 1971

Our mailing list is up to ~~3000~~ and growing 300 per month. We need your direct financial support in addition to your purchases. Please send $3 as a subscription for the Newsletter for 1970 if you think it is worthwhile; and, if you wish to have the designation MEMBER and to support the research work, send $10. We pledge that we will spend all available funds on research and education and will operate as a non-profit organization. Many thanks to all who have already sent in donations.

HOW TO FIND US



We are a mile southwest of South Park, which is on the west bank of the Duwamish across from Boeing Plant 2. From the north, head south on the Freeway 5 to Albro Place exit. Turn right four blocks, then half-left to East Marginal Way. Another half-left on East Marginal Way about 8 blocks to 16th South. Right on 16th, across the bridge into South Park. Continue 6 or 8 blocks over the overpass and head south on Des Moines Way. The next street to the right, west, is South 96th, at a Gulf station. Turn right on 96th a long block and look for the MSR on a large orange building ahead to the left. Time from the U of W, 17 minutes. From the center of town, 12 minutes.

From the south, get off the Freeway on West Marginal Way and go northwest to the Des Moines Way exit. Follow those signs around over the overpass and head south. Presto! There's the same Gulf station.

Display Room

Our display room has all items on display with a description and discussion-of-use sheet attached. Please read these, and then ask us about the points which are not clear. When you have made your choice, please fill out an order form and push the buzzer button. One of the fellows will come from the shop and fill your order promptly. These fellows are climbers, and will answer your questions if they can. If the questions are too tough, they will call on me. If I can't answer, I'll see if we can devise an experiment to get the answer. Probably we'll put you to work running the experiment yourself. There is a great deal yet to be done.

RETAIL STORE HOURS:

August 25 - March 25, Monday - Thursday 8 a.m. - 5 p.m., Friday 9 a.m. - 6 p.m.
CLOSED SATURDAY

MAIL ORDER BLANK OPPOSITE PAGE 12

WHY A RETAIL STORE FOR A RESEARCH ORGANIZATION?

Actually our first choice was to work on a budget as a research committee of The Mountaineers, Inc. of Seattle. The budget was not forthcoming, so our second choice was to pay the costs by selling basic equipment to students in The Mountaineers classes. Complications followed. Our third choice was to sell through Recreational Equipment, Inc. and Alpine Hut. Nyet. So, rather than have our work suppressed, we are in the retail and mail order business. We are also starting to market our equipment in Europe.

The sales we make have several purposes: to help finance our research operations; to apply economic pressure on merchants and manufacturers to improve their products by our offering of better products to the mountaineering fraternity; to help carry out our function of safety education by making people aware that such better products exist; to help validate and improve our work by direct feed-back of information and suggestions from our customers.

Considerable progress is being made. REI has taken all carabiners out of the 1970 catalog that break at less than 2800 pounds. The European manufacturers of ice axes are paying attention, following our exhibit at the Munich Sport Trade Fair in March. The Mountaineers are considering whether to restore the safety equipment and methods research committee that they abolished in May 1969. The Mountain Rescue people have been much interested and cooperative all along.

There is hope. With your support and help, we'll keep slugging!